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Baker

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May 6, 1999

Commander
Atlantic Division
Naval Facilities Engineering Command
1510 Gilbert Street (Building N-26)
Norfolk, Virginia 23511-2699

Attn: Mr. Robert Schirmer, P.E.
Code 18222

Re: Contract N62470-89-D-4814
Navy CLEAN, District III
Contract Task Order (CTO) 0388
Recommendations for Erosion Mitigation Measures – Area of Exposed Debris
Site 1 – Landfill near Incinerator
Fleet and Industrial Supply Center
Cheatham Annex, Williamsburg, Virginia

Dear Mr. Schirmer:

Baker Environmental, Inc. (Baker) is pleased to submit two copies of this Letter Report which addresses the erosion which is taking place along the north-east perimeter of the Site 1 landfill at the Fleet and Industrial Supply Center (FISC), Cheatham Annex, Williamsburg, Virginia. This letter was prepared under contract to the Atlantic Division, Naval Facilities Engineering Command (LANTDIV) Contract Number N62470-89-D-4814. Conceptual design recommendations are presented herein. Once LANTDIV agrees upon the proposed remedial alternative, Baker will provide additional design recommendations (specifications, vendor information, etc.).

On March 15, 1999, Baker visited Site 1 to view the clearing activities that were being completed as an interim measure to curtail erosion of the bank of the York River adjacent to the Landfill (discussed below). During this site visit Baker observed a thin layer of debris outcropping just below the ground surface along the upstream edge of the landfill. This indicated that the landfill extends to the bank of the York River over an approximately 60-foot long stretch. In this area the bank varies in height from approximately 2 to 10 feet. This area is being actively eroded and apparent landfill debris (chunks of ash, partially melted glass, etc.) is sparsely present on the beach in this area. A small, rusty pail containing an unidentified yellow substance is also present in the exposed debris that outcrops along the bank in this area.

This erosion area is difficult to access during high tide and is littered with fallen and washed-up trees and wood. It is not known how long the landfill contents have been washing out in this area. This document presents recommendations for protecting this erosion area (where apparent landfill material is exposed) from further erosion.

HISTORY AND SITE CONDITIONS

Site 1 - Landfill near Incinerator, is located along the York River behind the former location of the incinerator. The site is depicted on Attachment 1. The incinerator has been dismantled. Although the exact date of dismantling is unknown, it is estimated to have occurred between 1989 and 1992. From 1942 to 1951 the landfill was used as a disposal area for burning residues and from 1951 to 1972 as a general landfill. A variety of wastes, including empty paint cans and paint thinner cans, cartons of ether and other unspecified drugs, railroad ties, tar paper, sawdust, rags, concrete, and lumber, were burned and disposed in the landfill until 1981. After this time, the landfill was no longer used. An estimated 34,500 tons of solid waste were buried at the landfill during its operation (ESE, 1991). The landfill was closed in 1981 by re-grading, placing a 2-foot soil cover upon the debris and vegetating the soil cover. A fence encloses a portion of the landfill and vehicular access to this area by unauthorized personnel is restricted by a locked gate. There is no debris or other material on the surface of the landfill within the fenced-in area. The fence was installed as part of a government training activity unrelated to the landfill, and does not correspond with the landfill perimeter. Access to the portions of the landfill outside of the fence is prevented by rugged terrain and dense vegetation.

The bank of the York River is exposed to the east of the landfill. The bank varies in height from approximately 2 feet (upstream) to approximately 20 feet (downstream) along the edge of the landfill. Shoreline topography in this section of the York River consists of small sand beaches (average width 20 feet) bordered by high, actively failing bluffs at elevations of approximately 8 to 26 feet above Mean Lower Low Water (MLLW).

The edge of the landfill is apparently exposed just below the ground surface along the upstream bank over an approximately 60 foot long section. In this area, a thin layer of apparent landfill debris is visible. A small rusty metal pail which contains a small volume of an unidentified yellow substance can also be seen outcropping from the bank in this area. During high tide, the edge of the York River has been observed to advance within a few feet (laterally) of the exposed landfill in this area. It is suspected that during storm events, the waters edge advances to the toe of the bank, the toe is eroded by wave action, and the landfill debris is undermined. The toe erosion (as detailed in Baker's Shoreline Erosion Assessment Letter Report [1998] which is discussed further below) removes support of the overlying bank and leads to a "fall" type failure, where the undermined soil/debris migrates down-slope until equilibrium is achieved. Areas of recent soil slumping are present at the toe of the slope in this area. During low tide, the following debris can be observed in the flat, intertidal beach in this area: metal, wood, glass, charred material, apparently incinerated material including clumps of ash and molten glass; and pieces of asphalt. Although the beach is not densely populated with this debris, its presence is indicative of migration of landfill contents into the York River. While coarser debris remains on the beach, it is possible that finer materials (e.g., ash) have been transported further into the York River.

Where the bank of the York River achieves its greatest height (down stream of the exposed debris area), the edge of the landfill is estimated to be separated from the top of the bank by approximately 20 to 40 feet, measured laterally.

A large pile of surface debris is present to the west of the landfill. This area contains cables, conex boxes, an empty storage tank, automobiles, airplane/boat parts, drums, buckets/pails, and other miscellaneous items. Landfill contents (including metal scrap, wood, drums, containers, and other miscellaneous debris) are exposed along portions of the western perimeter of the landfill along the edge of the marsh associated with the unnamed tributary to the York River. During high tide, debris at the very toe of the pile is inundated.

SHORELINE EROSION ASSESSMENT REPORT

There is a steep drop to the York River and adjacent marsh area along the perimeter of the landfill. The areas immediately adjacent to the former landfill are, or were at one time wooded. The bank of the York River adjacent to the landfill is extremely steep (nearly vertical in areas), and is not vegetated. The York River is located at the toe of the steep slope, approximately 25 feet below the landfill surface. Baker conducted a limited shoreline erosion assessment on the 400-foot long portion of river bank in the vicinity of Site 1. Baker submitted the shoreline erosion assessment in the form of a letter report dated August 14, 1998. In general terms, the assessment concluded that the erosion of the river bank is attributable to high water levels and wave action. The erosion is increased by factors such as wind, poor vegetation, and the presence of large trees along the top of the bank. As an interim measure, Baker recommended clearing trees within a distance of approximately two bank-heights (i.e., approximately 50 feet) from the toe of the slope, and establishing low-growing vegetation. The long-term solution recommended in this document consisted of a design incorporating both structural and non-structural features. A rubble-mound revetment would protect the lower bluff region, with a crest at elevation 9 feet MLLW and a slope of 1V:2H. The upper bluff region would be graded, cutting back the existing slope to a stable 1V:2H slope. These recommendations are in general agreement with recommendations presented by Mr. Lee Hill, Virginia Department of Conservation and Recreation (VDCR), who reviews designs of shoreline erosion protection measures along the York River. A tree service company (contracted by LANTDIV) cleared the trees along the landfill perimeter (as recommended) in winter and early spring of 1999.

Baker is currently preparing Project Plans for a pre-design investigation that will be used in the design/development of remedial measures that will be implemented for the landfill. The appropriate measures will be selected via an Engineering Evaluation/Cost Analysis (EE/CA) that is also planned for the site. It should be noted that the rip rap revetment is just one option that will be considered in the EE/CA. Other options such as no further action, excavation and off-site disposal of the landfill contents, re-grading and capping, and implementation of various monitoring programs may also be considered. If appropriate, alternate shoreline protection measures will be considered.

1999 FIELD INVESTIGATION REPORT

Baker recently submitted the Draft version of the Field Investigation Report for Site 1 and Area of Concern (AOC) 2. This document presented the findings of investigations that were conducted in October 1998. In short, significant contamination (primarily lead and polynuclear aromatic hydrocarbons [PAHs]) was detected in soil and sediment samples collected along the western perimeter of the landfill. The following recommendations were presented in this document:

- Remove surficial debris that has collected on the flat intertidal beach area in the vicinity of the eroding bank. Do not remove the fallen trees or timbers which have collected on the beach as these provide a measure of erosion protection [unless removal will accommodate installation of other toe protection measures]. The collected debris should be stored, characterized and disposed of properly.

- Develop and implement (interim) measures that can be quickly installed to mitigate erosion in the area where the landfill perimeter is exposed along the York River. Protecting the toe of the slope will prevent undermining and eliminate migration of debris into the York River. Impact to the adjacent wetlands and to the York River should be evaluated prior to

implementing these measures. These efforts should be coordinated with the concerned agencies (VADEQ, USEPA, US Army Corps of Engineers, Virginia DCR, etc.).

- Institute a periodic inspection program so that the condition of the slope can be monitored and documented. The inspections will also serve to verify the effectiveness of the interim measures (i.e., confirm that migration of debris into the York River is not occurring). A catastrophic failure of the higher portion of the bank (although not anticipated) would be discovered during the routine inspections. Finally, erosion rates along the top of the bank could easily be determined by installing measuring stations/reference stakes.

- Remove the small rusty container outcropping along the northern perimeter of the landfill and characterize the yellow residue. Removal and characterization will eliminate the possibility of migration of the unknown substance into the York River and adjacent wetland. Further, characterization will furnish information regarding the types of substances that were disposed in the landfill.

- Develop and implement solutions for long-term management of the landfill. Potential solutions may include excavation and disposal of the landfill contents, installation of a protective revetment along the toe of the slope to curtail erosion, regrading to improve drainage, installation of a more substantial cap and cover, and removal of surficial debris. Selection of the most appropriate actions should be determined via an EE/CA, and additional data should be collected in order to ensure that the most appropriate solution is selected and can be instituted as planned. The additional data that is required includes vertical extent of landfill debris, volume of landfill debris, disposal characteristics of the landfill debris, geotechnical characteristics of the soils comprising the existing bank, assessment/delineation of wetlands along the landfill perimeter, groundwater conditions down gradient of the landfill, a detailed topographic survey of the site, assessment of the existing soil cover, and evaluation of the site with respect to of Virginia's Open Dump Policy.

DEVELOPMENT OF DESIGN ALTERNATIVES

The upper limit of the 60-foot section, deemed the critical erosion area, begins approximately at the upstream limit of the original 400-foot section study area and travels downstream. The shoreline topography at the upper limit consists of low-lying marsh (approximate elevation 2 feet MLLW) jetting out eastward into the river. Progressing downstream, the topography divides into two distinct regions, the sand beach and the formation of the bluff ridge as the land elevations rise from elevation 2 feet MLLW to elevation 16 feet MLLW. The critical erosion area, as outlined by the red arrows is depicted in Photographs 1 and 2.

The timeframe for construction of the permanent solution is currently being established, but implementation of the permanent solution may not occur for a few years. LANTDIV has requested Baker to assess the feasibility of using temporary low-cost shoreline protection solutions to curtail erosion and subsequently eliminate further migration of landfill contents into the York River prior to the construction of the permanent solution.

Several constraints were placed on the type, size, and cost of the shore protection system to be applied. Although LANTDIV operates under CERCLA and is exempt from federal and state permit requirements, one of the goals was to follow the essence of the permit requirements as much as possible. Therefore, a concerted

effort was made to avoid or minimize impacts to the shoreline and York River as part of the solution. Impacts to wetlands, submerged aquatic vegetation, and/or dredging of the York River were avoided by setting the construction line landward of the Mean High Water (MHW) level. Another constraint placed on the solution was to minimize or avoid excavation of the landfill and surrounding bluff. Excavation of landfill contents could potentially generate significant quantities of potentially hazardous waste, subject to special disposal requirements. Additional constraints were also placed on the type of shoreline alternatives examined such that future removal or integration into the permanent solution could be accomplished at minimal cost.

Design criteria for each solution evolved by balancing the level of protection afforded the bluff by the structure versus the functional timeframe of the solution. In this situation, the two issues are dependent on each other. The level of protection afforded by the structure is governed by the life expectancy of the structure. Assuming a 5-year design life for the temporary solution, the probability of storm event greater than a 15-year storm event occurring during this period is less than 50%. Designing to more stringent criteria is not cost-effective. A 15-year return period storm translates into a design water level at elevation 6.50 feet MLLW and a wind-generated wave height of approximately 3 feet. Design water levels developed by the Federal Emergency Management Agency (FEMA) as part of the National Flood Insurance Program for various return periods were reviewed to determine the specific design water level at this site. Records from local airports were reviewed to determine the 15-year return period wind. Using USGS topographic mapping, wind-wave generating fetch lengths were determined. Finally, the US Army Corps of Engineers' Automated Coastal Engineering System Computer Program (ACES) was run to determine the wind-generated wave for the 15-year wind event.

ALTERNATIVE 1 – SHORELINE REVETMENT USING GEOTEXTILE TUBES

A geoxtextile tube, composed of woven polypropylene material and filled with sand, is placed in a staggered configuration along the bluff toe to prevent further erosion. The crest elevation of the tube has been set at elevation 7.5 feet MLLW. Since the geotextile tube requires little excavation, the base of the tube will be placed just above the MHW line. The tube itself will be approximately 5 feet high and given its ellipsoid shape, the width of the tube will be approximately 12 feet. The tube will have freeboard of approximately 1-foot above the still water elevation, with the freeboard acting as a buffer to reduce or eliminate wave action attacking the bluff face. Since the geotextile tube may not be flush with the bluff face, additional fill material can be placed between the tube and the bluff to further reduce the erosional forces. This material can either be soil or crushed quarry stone. A coarse, poorly graded aggregate is recommended to enhance drainage. A small geotextile tube, placed at the toe of the main tube, will provide scour protection.

Structurally, the tubes are very stable, owing to their weight. The polypropylene shroud is resilient to tears, ultraviolet light, and to biological and chemical environments found in soils. A benefit of the geotextile tubes is the ease of construction. Only fill material and the equipment required to place the fill will be required. Acquiring fill directly from the site by dredging the York River was considered, however, dredging may induce permitting issues with federal and local agencies, which can be avoided if imported material is used. Furthermore, the material dredged from the river may not be the most suitable material, (due to grain size). To obtain the a 5-foot high tube height, the most suitable material to use as fill is sand, with a grain size between 0.2 and 0.3 mm. This size sand dewaters and consolidates quickly, allowing the tube to be filled to the required elevation in little time. If the material is too fine or contains sediment that retains water more readily, reaching the final tube crest elevation may not be achievable or take a considerable amount of time. Since sand is readily available and fairly inexpensive, importing the material would reduce or eliminate unwanted construction problems.

The staggered configuration of the tubes, as shown in Figure 1, conforms to the changing bluff face orientation. A minimal amount of excavation will be required at the upstream end of the bluff to accommodate the northern geotextile tube. In general, the geotextile tubes are malleable prior to fill placement and can conform to subtle changes in the bluff face without the need for excavation. Another benefit of the tube is the low cost of removal. Typically, the fabric is cut and the fill material allowed to settle onto the beach. Prior to placing the backfill behind the tube, Baker recommends that geotextile fabric be draped over the face of the slope and secured to the slope. This fabric will provide a measure of protection against the erosive forces of wind and runoff acting against the exposed slope face above the design elevation. When the structure is removed, the fabric will prevent outcropping debris from being mixed in with the fill material that is removed. The fabric should be secured at the top of the slope (on the flat area) by sand bags or other non-intrusive anchoring methods to avoid trenching and unearthing of landfill materials.

The estimated cost for this alternative including clearing and mulching, geotextile tube installation, beach clean up (debris removal, characterization and disposal), characterization/disposal of yellow residue, geotextile installation, backfilling, re-vegetation, and construction coordination is approximately $24,000 to $28,000.

ALTERNATIVE 2 – GEOTEXTILE TUBE USED AS A BREAKWATER

Utilizing the geotextile tubes as in Alternative 1, this concept refocuses the functionality of the structure from a revetment to a detached breakwater. The revetment provides wave and water level protection to the bluff toe whereas the breakwater has been designed to significantly reduce wave action at the bluff toe only. Since the waves act as the main mechanism initiating the suspension and transport of sediment from the bluff face, the probability of future erosion and subsequent failure of the bluff is reduced. The breakwater, however, doesn't reduce the possibility of soil saturation from high water levels. The dimensions of the breakwater geotextile tube are the same as the revetment, with a crest elevation of 7.5 feet MLLW. As with Alternative 1, a small geotextile tube, placed at the toe of the main tube will provide scour protection.

Construction of the geotextile breakwater is similar to the revetment. Since the breakwater is positioned at the MHW line, excavation of existing land is further minimized. This alternative, however, does not offer any erosion protection against wind or surface water runoff for the exposed debris.

Construction costs including clearing and mulching, geotextile tube installation, beach clean up (debris removal, characterization and disposal), characterization/disposal of yellow residue, re-vegetation, and construction coordination is approximately $17,000 to $21,000.

Alternative 2 is depicted on Figure 2.

ALTERNATIVE 3 – ARMORFLEX BLANKET REVETMENT

Alternative 3 is considered a more traditional shore protection approach to the prevention of bluff erosion. A revetment, with a front face slope of 1V:2H, situated in front of a flat berm, provides wave and water level protection to the toe. Typically, the revetment face is protected by armor or riprap stone. However, placement and removal costs tend to make this option more costly. Placement of the stone is made difficult since the stone can not be just dumped but instead must be placed in the correct position. Removal is also hampered since stone requires sorting if reuse is an option. As an alternative to stone, a concrete block mat can be placed

along the face of the revetment and the top of berm and will provide the equivalent levels of wave and water level protection to the bluff toe.

One such concrete block system, called Armorflex™, is comprised of cellular concrete blocks of a unique interlocking shape, which are cabled longitudinally by means of galvanized steel aircraft or polyester cables. The interlocking of the blocks forms a monolithic mat, which lies atop the revetment and berm surfaces. The weight of the entire mat aids in the stability of the structure and has been designed to withstand wave conditions upwards of 5 feet. The benefits of this system versus stone lie in the ease and low cost of placement. Each section of the mat (8-foot wide by 25-foot section) can be placed using a crane. Since the mats can be maneuvered into place easily, multiple mats can be placed within a short time. Removal of the mats again requires a crane.

The crest elevation and berm width of the revetment were based on structure stability and wave runup concerns. Theoretical wave runup has been estimated at 4 feet above design stillwater elevation. Based on this calculation, the revetment crest height would need to be set at elevation 10.5 feet MLLW. However, the placement of an 8-foot wide berm behind the revetment face will attenuate a portion of the wave height. After several iterations, a final revetment crest elevation of 8 feet, with an 8-foot wide berm was determined to be sufficient to protect the bluff face. The total horizontal footprint of the revetment structure is 20 feet, which would require little excavation at the site to facilitate construction. All construction would be landward of the MHW line. Additional anchoring of the mat would not be required since the weight of the mat would act to anchor itself to the underlayers of the revetment. The underlayers of the revetment are composed of compacted soil topped with a layer of geotextile material. The geotextile material is placed to relieve hydrostatic pressures and to prevent leaching of subsoils. Partial embedment of the concrete blocks below existing ground level will provide scour protection. The optional placement of crushed stone or gravel between the concrete blocks would provide additional interlocking.

Removal of this temporary solution would require a crane and some equipment to either dispose or regrade the fill material. The concrete block system could possibly be reused again by modifying the long-term solution to incorporate this system.

The estimated cost for this alternative including clearing and mulching, revetment installation, beach clean up (debris removal, characterization and disposal), characterization/disposal of yellow residue, geotextile installation, backfilling, re-vegetation, and construction coordination is approximately $31,000 to $35,000.

Alternative 3 is depicted in Figure 3.

RECOMMENDATIONS

Each alternative provides the same level of protection of the bluff toe. Selection of the appropriate alternative can be made based on three issues: ease of construction; cost of construction; and the removal or incorporation of the temporary design with the long-term solution. Weighing these three issues, Alternative 1 meets or exceeds the requirements. Baker recommends the construction and placement of Alternative 1 as soon as possible to reduce the potential for continued erosion and eliminate the migration of landfill contents into the York River. This alternative should be implemented in conjunction with the recommendations presented in the Field Investigation Report which include removal of debris which has collected on the intertidal beach area, removal and characterization of the yellow residue which is contained in the small, rusty metal container which

outcrops just below the ground surface, implementation of a routine inspection program; and development of strategies for the long-term management of the landfill.

Overall, this solution provides the necessary protection and does not require permitting intervention with other federal agencies. At the Commonwealth of Virginia level, Mr. Lee Hill, Chief Shoreline Engineer for the VDCR has been informed of the need for temporary shoreline protection and concurs that (conceptually) Alternative 1 is a viable short-term solution.

Alternative 2 ($17,000 to $21,000) would be less costly to install. However, this alternative does not provide the toe protection and support offered by Alternative 1. In addition, Alternative 1 provides protection of the exposed debris from wind and surface water runoff by covering the area with geotextile.

The estimated cost for this alternative ($24,000 to $28,000) was based on conceptual design parameters and is presented for budgetary purposes only. Additional costs, such as construction inspection and implementation of a routine inspection program have not been factored in.

At the time of construction, Baker recommends that the tree limbs and branches that have collected along the shoreline (in the critical erosion area) be moved to the top of the bluff and mulched. The mulch can be spread on the ground surface or taken off-site for beneficial use if practical. Once the proposed remedy for the critical erosion area is agreed upon, a public notification should be issued. Remedial measures should be in the form of a time-critical removal action. An action memorandum will need to be issued for this work.

Baker appreciates the opportunity to provide continued service to LANTDIV and looks forward to continuing these very important project activities at CAX. If you have any comments regarding this letter, please contact me at (703) 317-6221, or Mr. Martin Taube (Project Manager) at (412) 269-4687.

Sincerely,

BAKER ENVIRONMENTAL, INC.

FOR Mark Pirrello, P.E.
Senior Coastal Engineer

MGT/lp

cc: Ms. Ollie Glodis. Code 02116 (letter only)
Ms. Carolyn Neill, Code 09E (two copies)
Mr. Dennis Brittin, Code BX0 (one copy)
Mr. Robert Thomson, P.E., USEPA (two copies)
Mr. Lee Hill, VDCR (one copy)
Ms. Sharon Wilcox, CHMM, VDEQ (two copies)

ATTACHMENTS

LEGEND

– APPROXIMATE EXTENT OF TOP OF BANK WHERE THIN LAYER OF DEBRIS IS EXPOSED

– APPROXIMATE EXTENT OF BEACH AREA WHERE (APPARENT) LANDFILL DEBRIS IS SPARSELY PRESENT

METAL DEBRIS PILE

YORK RIVER

DEBRIS (GLASS, WIRE, NAILS, TAR) TO 1.5 FEET

DEBRIS (CHARRED MATERIAL, GLASS, METAL) TO 1.0 FEET

EBB

FLOOD

TOP SOIL WITH TRACE DEBRIS TO 1.0 FEET

CLAY WITH BLACK ASH REFUSAL AT 1.0 FEET

METAL STORAGE TANK

EDGE OF LANDFILL (INTERPRETED)

TRACE COARSE ASH NODULES IN SILTY SAND MATRIX. REFUSAL AT 3.0 FEET

NO DEBRIS TO 3.0 FEET

NO DEBRIS TO 3.0 FEET

TOP OF BANK

TOE OF SLOPE

SHORE LINE (VARIES)

1GW07

UNNAMED TRIBUTARY TO THE YORK RIVER

NO DEBRIS TO 4.0 FEET

1GW01

NO DEBRIS TO 8.0 FEET

1GW06

1GW03

NO DEBRIS TO 8.0 FEET

EDGE OF LANDFILL (GEOPHYSICS)

1GW08

1GW04

1GW02

8' CHAIN LINK FENCE

EDGE OF LANDFILL (INTERPRETED)

SILTY SAND TO SILT TRACE ROCK FRAGMENTS, CHARRED WOOD TO 3.0 FEET. NO DEBRIS BELOW 3.0 FEET

DARK BROWN CLAYEY SILT WITH SAND, TRACE, PLASTIC, BRICK, GRAVEL TO 4.0 FEET. NO DEBRIS BELOW 4.0 FEET

ENTRANCE

ACCESS ROADS

CONCRETE DRAINAGE CHANNEL

1GW05

RAILROAD TRACKS

E STREET

50 0 25 50

1 inch = 50 ft.

388524SI

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Baker Environmental, Inc.

LEGEND

– MONITORING WELL LOCATION

– APPROXIMATE HAND AUGER BORING LOCATION

– APPROXIMATE DIRECT PUSH BORING LOCATION

23.94 – GROUND SURFACE SPOT ELEVATION (FEET ABOVE MEAN SEA LEVEL)

– APPROXIMATE ℄ OF DRAINAGE WAY WITH (EBB) FLOW DIRECTION

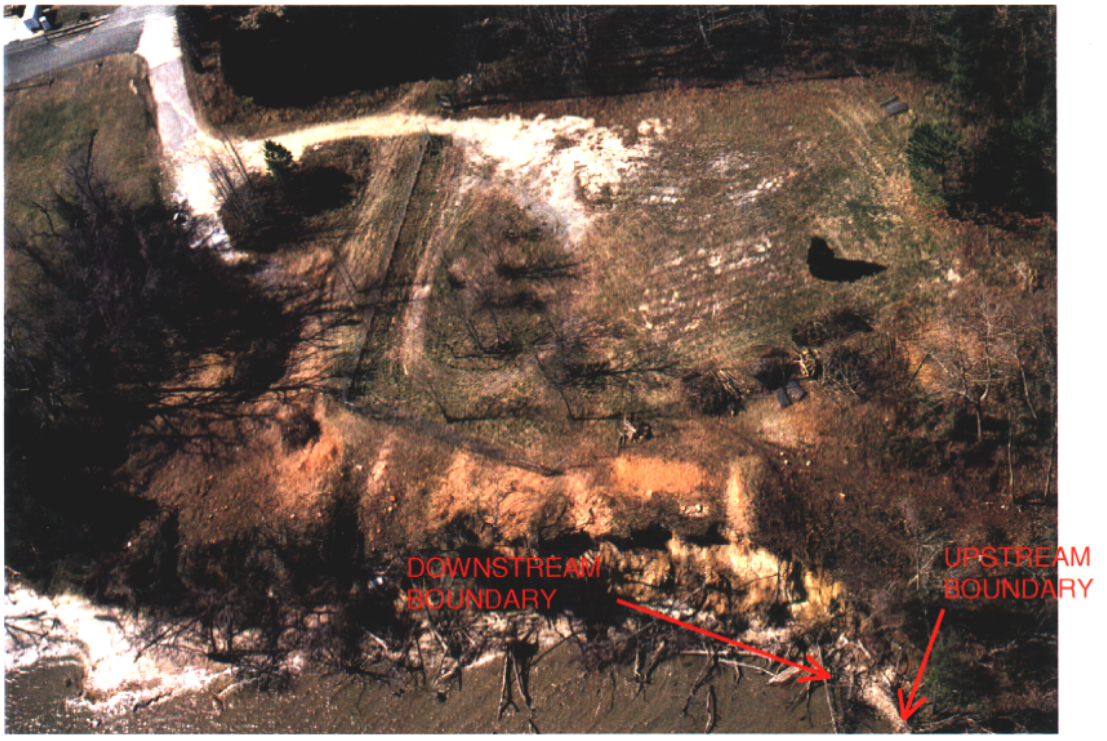
NOTE:

1.) BORINGS 5 THRU 12 ARE APPARENTLY SITUATED IN AREAS IN WHICH FILL (REWORKED SOIL) WAS PREVIOUSLY PLACED. REWORKING WAS EVIDENT IN SOIL STRUCTURE AND BY THE PRESENCE OF (VERY MINOR AMOUNTS) OF DEBRIS. THESE AREAS ARE INTERPRETED TO BE OUTSIDE OF THE LANDFILL.

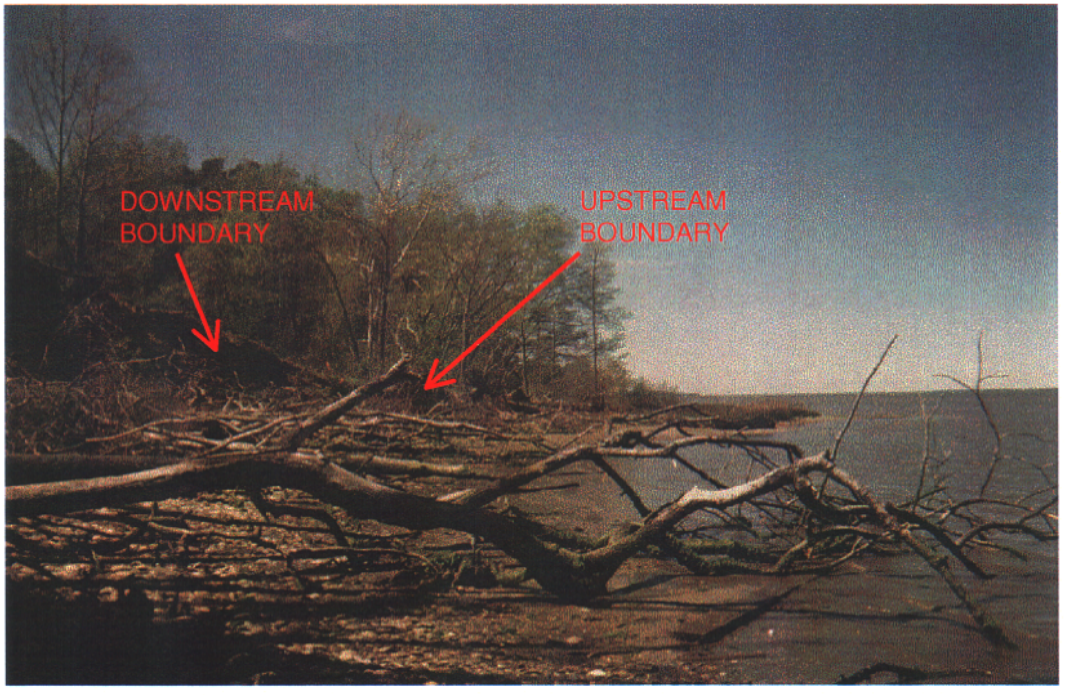
SOURCE: PHR & A, 1998.

ATTACHMENT A
EXISTING CONDITIONS PLAN
SITE 1
CTO – 0388

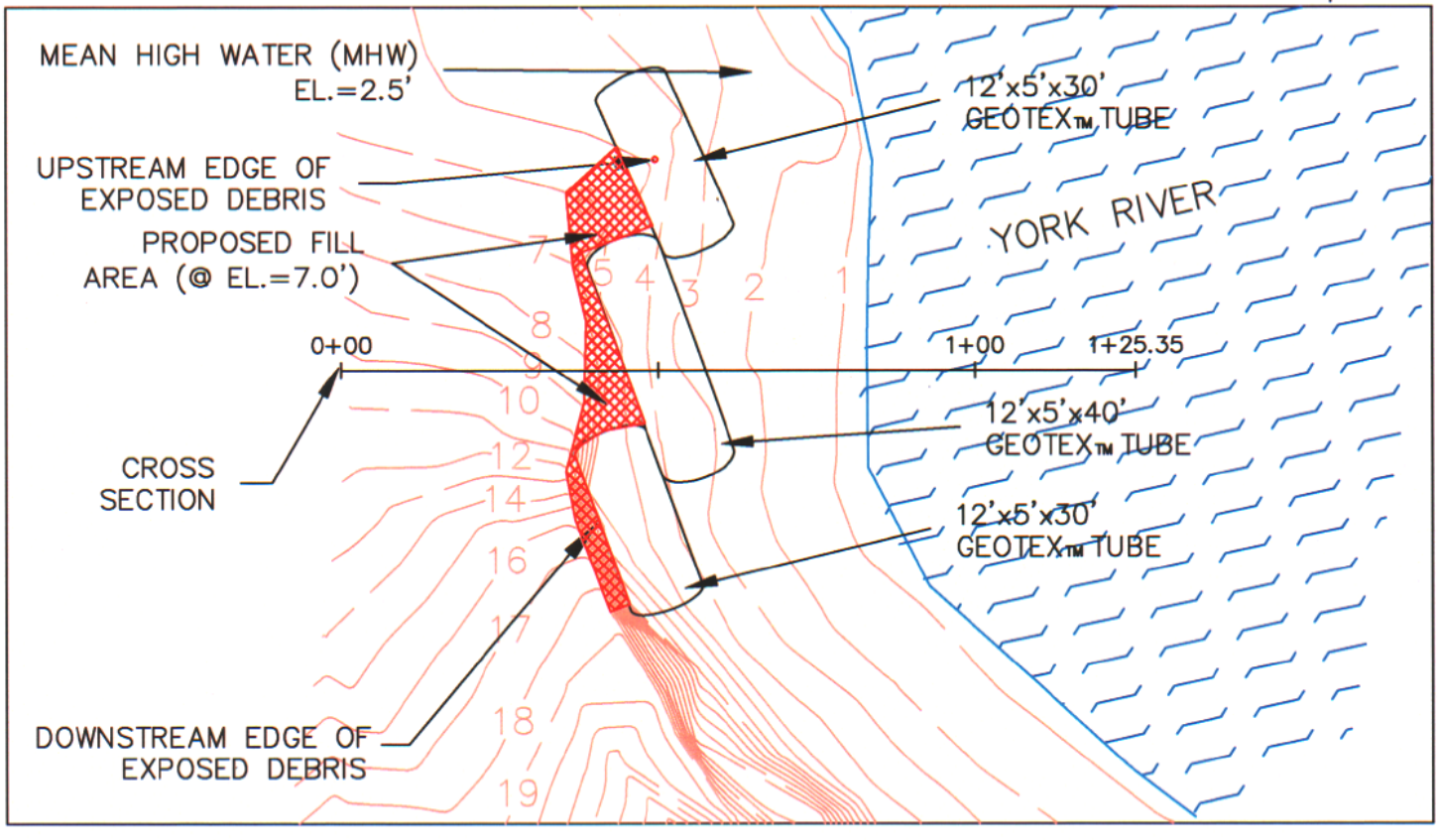
FISC, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA



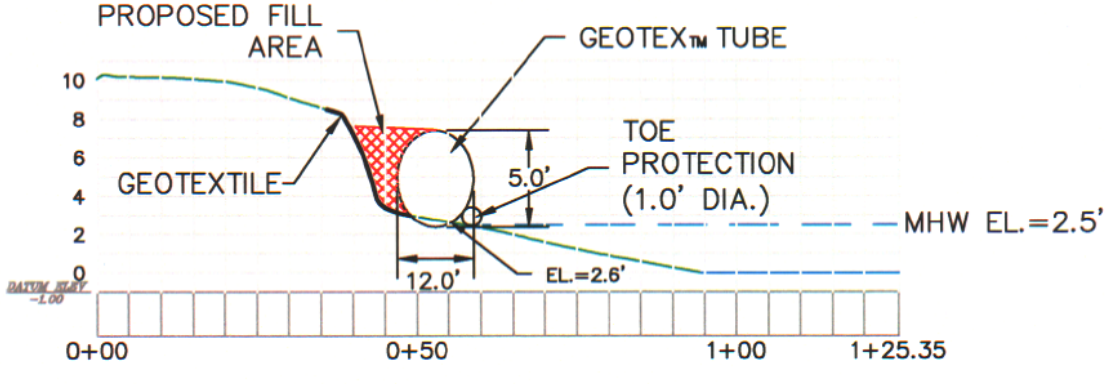
Photograph 1 – Critical Erosion Area from Aerial Vantage Point



Photograph 2 – Critical Erosion Area from Downstream Vantage Point



PLAN



TYPICAL CROSS SECTION
(VERTICAL EXAGGERATION 3X)

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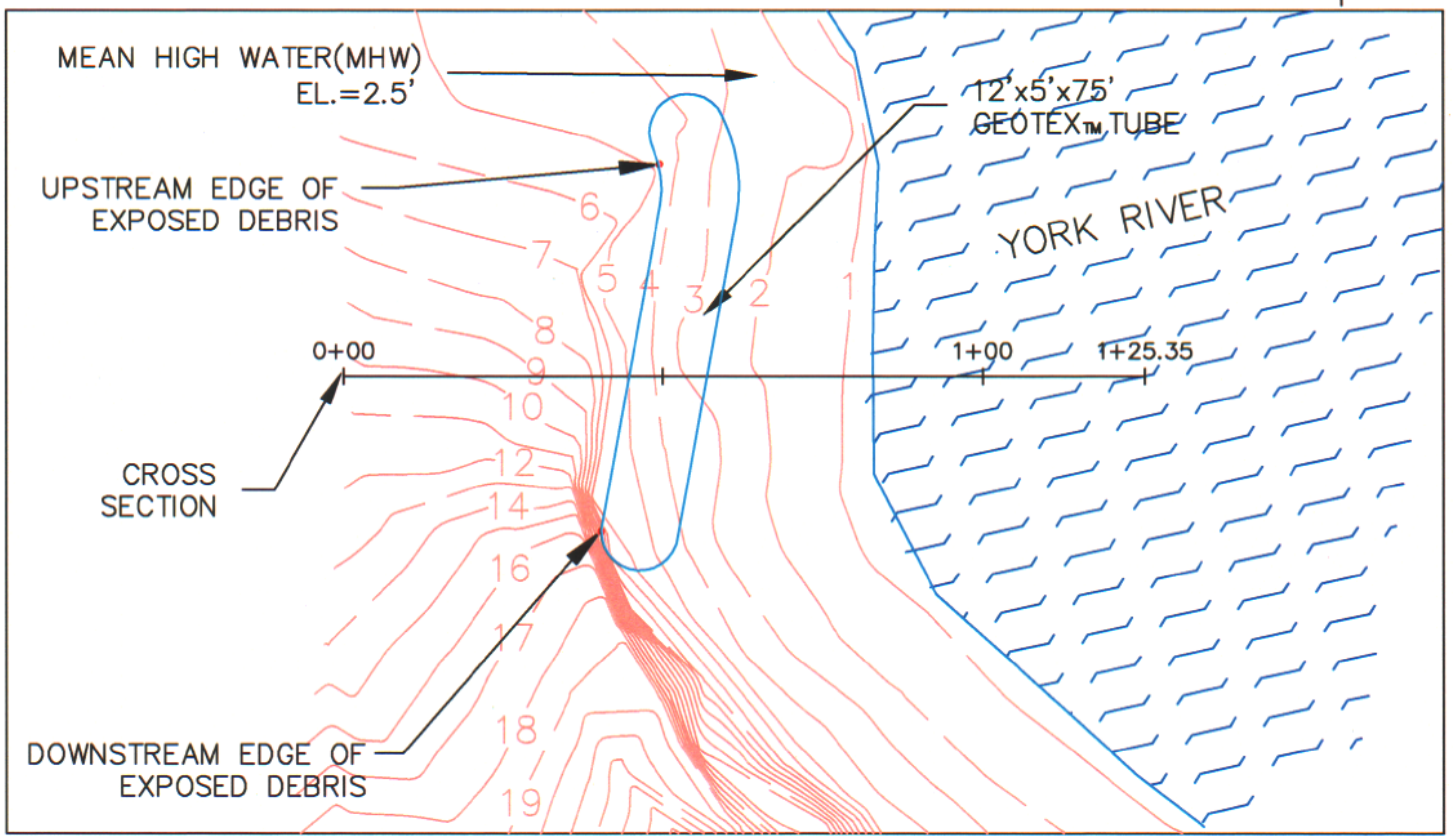
Baker

NOTES:

1. ELEVATIONS SHOWN IN FEET ABOVE MEAN LOWER LOW WATER (MLLW).
2. TOPOGRAPHIC SURVEY BY PATTON, HARRIS, RUST & ASSOCIATES, APRIL 16, 1999.

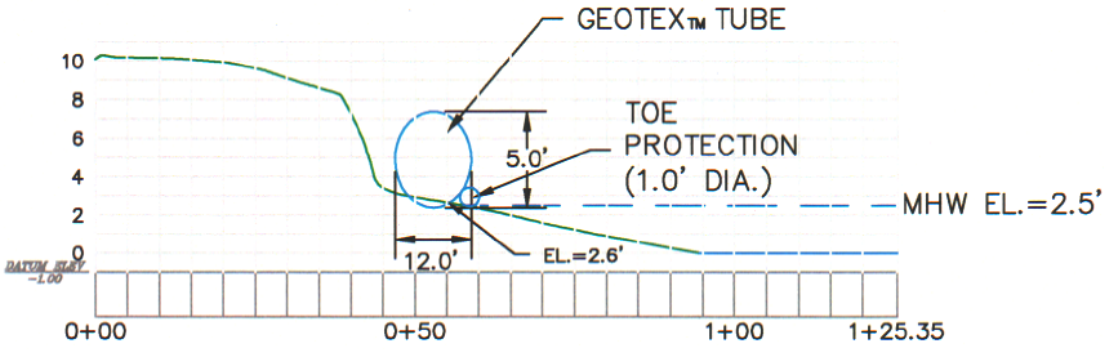
FIGURE 1
CONCEPT 1
GEOTEXTILE REVETMENT

CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA



PLAN

30 0 15 30
1 inch = 30 ft.



TYPICAL CROSS SECTION
(VERTICAL EXAGGERATION 3X)

388522SI

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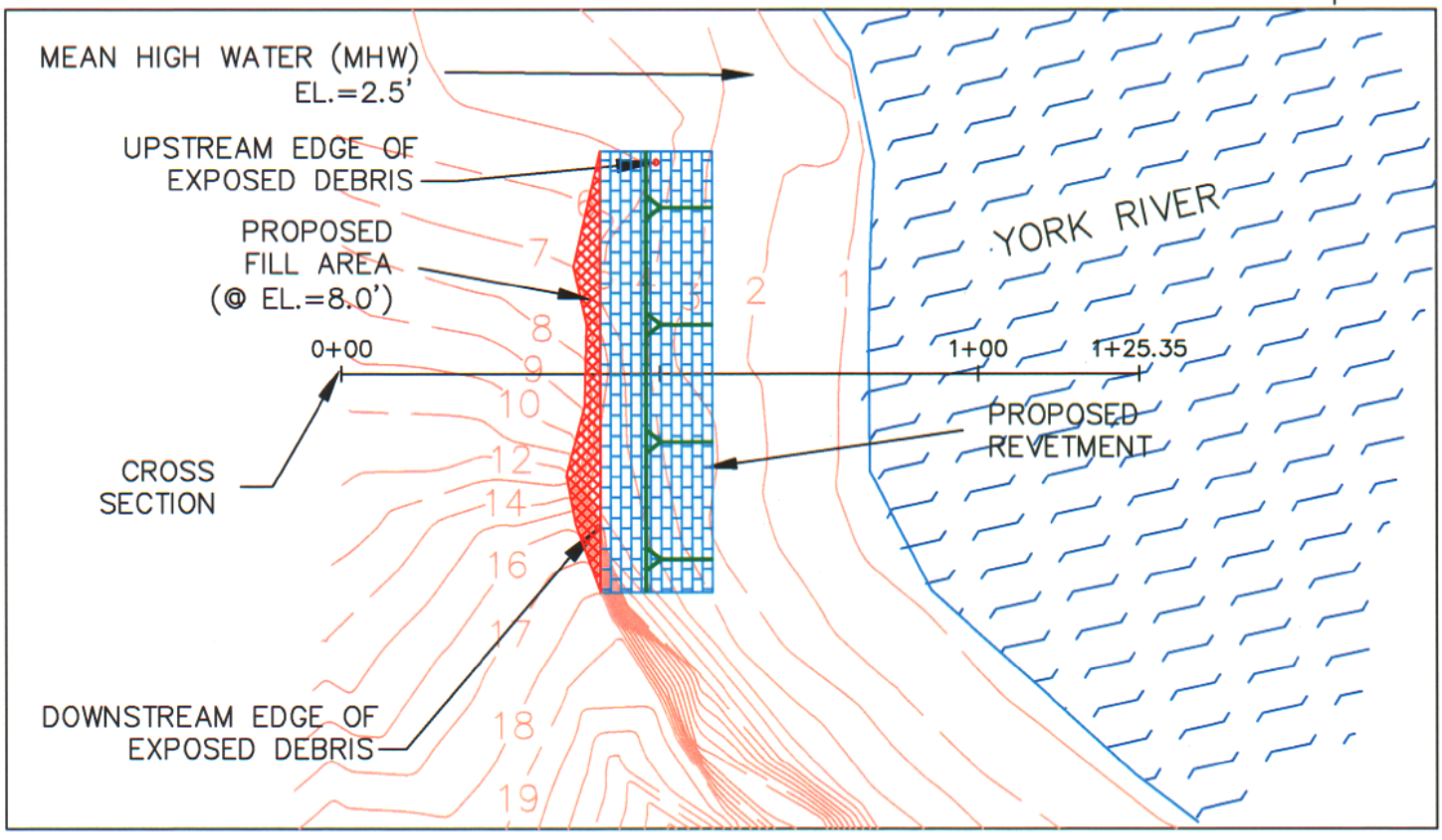
Baker

NOTES:
1. ELEVATIONS SHOWN IN FEET ABOVE MEAN LOWER LOW WATER (MLLW).
2. TOPOGRAPHIC SURVEY BY PATTON, HARRIS, RUST & ASSOCIATES, APRIL 16, 1999.

FIGURE 2
CONCEPT 2
GEOTEXTILE BREAKWATER

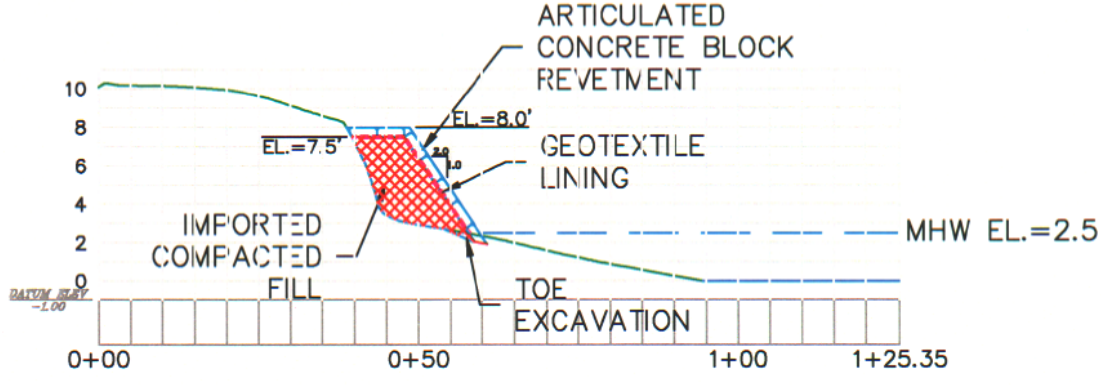
CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA



30 0 15 30

1 inch = 30 ft.

PLAN



TYPICAL CROSS SECTION
(VERTICAL EXAGGERATION 3X)

388523SI

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Baker

NOTES:

1. ELEVATIONS SHOWN IN FEET ABOVE MEAN LOWER LOW WATER (MLLW).
2. TOPOGRAPHIC SURVEY BY PATTON, HARRIS, RUST & ASSOCIATES, APRIL 16, 1999.

FIGURE 3
CONCEPT 3
ARMORFLEX REVETMENT

CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA